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effort of the amateur philanthropist will go for nothing. Until the medical expert wakes to the need of a close co-operation with those agencies whose specific work it is to achieve for the working man and the working woman shorter working hours and more sanitary working environment, his own efforts to stem the tide of pernicious anæmia and other life-sapping conditions in his patients will be of little avail.

But the necessity of meeting conditions of this kind is, from the nature of things, less frequent in the case of those patients who are treated at home than with those whom the physician meets in the clinics and the wards of the hospitals. What then must in a minor degree be recognized by the physician in his private practice, must become the embodied wisdom of the hospital. That hospital falls short in its prime purpose which fails to co-ordinate its work with other social, philanthropic, and educational forces in the community, and which does not maintain that co-operation both before and after the actual treatment of the patient. Emphasis has been laid by others upon the need of continuity in social service on the part of hospital authorities, but of equal importance with the study of the social environment into which the patient goes after his leaving the hospital, if a permanent cure is to be effected, is obviously the study of the environment out of which he comes, if an adequate diagnosis of his case is to be made. Thus, the hospital must realize itself as a great social force and not content itself to be, as unfortunately it frequently is, the mere adjunct or laboratory of some medical school.

(*To be continued.*)

PREPARATION AND USES OF INFUSIONS *

By FRANCES A. MYLES, R.N.
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By the term infusion we mean the injection of fluids into subcutaneous tissue, or hypodermoclysis. Infusions are used in cases where patients have lost considerable body fluid, and the intake is not sufficient to make up this loss.

The symptoms that call for infusions are the sunken eyes, depressed fontanelle, prostration, weak, rapid pulse, excessive and persistent diarrhœa and vomiting, and sometimes restlessness, in very bad cases. When a babe is in this condition there is apparent need of urgent and immediate absorption of fluid, and this is best accomplished by infusion.

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* As given to the Class of 1912 of the Boston Floating Hospital.

The fluids most commonly used are: normal saline solution, dextrose five per cent., the combination of normal saline solution plus dextrose five per cent., and rarely the combination of saturated solution sodium bicarbonate plus dextrose five per cent.

The normal saline solution, as one of our safest stimulants, can be used in all our diarrhœa cases, and is used extensively. Dextrose is a stimulant, but its chief characteristic is its nutrient value. It is given in bacillary dysentery, and in the ordinary diarrhœa, where there is no sugar in the urine. It is never given in the diarrhœa caused by the gas bacillus, as it will cause a rise in temperature and an increase in all symptoms in these cases.

It is readily seen that the normal saline solution is given in cases when *stimulation* is the greatest need, and that the dextrose is given where *nutriment* comes first and stimulation is secondary. The combination of normal saline solution plus dextrose five per cent. has become popular (where sugar can be used), as it serves a double purpose,—stimulation plus nourishment. The combination of saturated solution bicarbonate of soda plus dextrose five per cent. is not a favorite, because of its tendency to destroy the tissues, causing deep sloughs. It is used in cases of excessive acidity.

In the preparation of these fluids our greatest need is absolute sterilization. Everything to be used must be sterilized before we begin, such as pitchers, spoons, bottles, flasks with rubber stoppers and glass tubes, salt, water, etc. In making the normal saline solution, it is very much better to use the compressed tablets of sodium chloride, which come put up in small or in large bottles, and are supposed to be sterile. These should be kept well stoppered with sterile absorbent and cork. If these cannot be obtained, use common salt, taking care that starch has not been added. This salt must be sterilized before using (one drachm added to one pint of water is the approximate amount). To water that has already been sterilized add one salt tablet to every four ounces of water, or one drachm of ordinary salt to every 16 ounces of water. When thoroughly dissolved, filter three times. For the first filtration use two sheets of paper and a square of sterile absorbent; the second and third times one piece of filtering paper is sufficient with the sterile absorbent. After filtering three times, the fluid is ready to be sterilized, and should be sterilized on three consecutive days (20 minutes each day). If a sterilizer is not available, boiling for 20 minutes on three consecutive days is an equivalent. If we are using the 8-ounce flasks, the fluid should be put in these flasks, endeavoring to have rubber stoppers fitting tightly and securely tied on, and glass tubing (one short piece for escape of fluid, and one long piece to admit air), to be a "tight fit." Even then, after sterilizing they are apt to become loose and to be leaky. The tops of these flasks must be covered with a pad made from absorbent and gauze sufficiently large to cover the entire stopper and part of the neck of the flask. These covers cannot be on the flasks while sterilizing, because they will "blow off," or, if they are too air-tight for that, we run the risk of breaking the flask. We can have the pads sterilized before and put them on with aseptic hands immediately or sterilize them at the same time.

Dextrose.—In making dextrose, the same method is followed. Dextrose, as we already know, is more easily absorbed than any of the sugars. It is prepared in Germany by Kahlbaum, and we receive it in a chemically pure condition in crystals. Kahlbaum's preparation is the only one that ought to be used, because of its *absolute safety.* These crystals are dissolved in sterile water. It can be bought in tubes, a sufficient quantity in each tube to make one pint of 5 per cent. solution. (Martindale.)

The combination of normal saline solution plus dextrose 5 per cent. is made either by adding the crystals to the 8-ounce solution of normal saline, or by having a 10 per cent. solution of dextrose and using four ounces of this as part of the eight ounces of water in making up the normal saline solution. The filtering and sterilizing are the same as for the plain normal saline solution.

The combination of saturated solution sodium bicarbonate plus dextrose 5 per cent. is prepared in the same manner. After sterilizing this under pressure, we find it changes color, and if tasted we would find it tasted of burned sugar, which is what it practically is. This is due to the fact that heating the sodium bicarbonate to such a high temperature changes it into plain carbonate of soda, and in doing this it burns the sugar. Sterilizing this combination without pressure, *i.e.,* boiling 20 minutes for three consecutive days, we find it does not become as dark, and usually is a pale-lemon color. Even though the greatest possible care is used in the preparation, sterilization, and giving of this combination, we are very apt to have cellulitis.

Administration.—Our fluid is heated to a temperature of 105°. With practice we can tell this temperature by placing the flask to our cheek or to the inner side of the wrist. A sterile thermometer can be used, but in doing this the fluid is contaminated by the air. The fluid can be left standing in water of 105° until ready to be used.

Tubing and Needles.—The tubing connected with a glass "Y" should be wrapped in a towel and boiled from 10 to 20 minutes. The needles should be done separately and only boiled for a few minutes. Adding bicarbonate of soda to the water helps materially to prevent rusting.

Preparation of Area.—Infusions can be given under the shoulder-blades, subpectorally, and into the abdominal wall. With our babies we ordinarily use the abdominal wall. The babe is placed on its back, the shoulders and arms are covered with a blanket, and the bedding is turned down to expose the abdomen. After scrubbing our hands thoroughly, we wash the abdomen with warm water and liquid soap, rinse with sterile water, then alcohol 70 per cent. If not more than one or two infusions are given in twenty-four hours, bichloride of mercury 1–2000 is used instead of sterile water; otherwise this is omitted, because of the tendency to dermatitis. If the babe is ready before the physician, the area must be covered with sterile gauze or towel. After the needles are inserted a sterile covering is put over them, then a light-weight blanket to keep the bowels warm. It usually takes from one-half to three-quarters of an hour for eight ounces to be injected. There is a marked change in the patient after an infusion is given: the eyes are less sunken, the fontanelle does not appear as depressed, the babe is brighter, its pulse stronger, and frequently it drops into a quiet sleep. In some instances we do get considerable shock, and the skin becomes cold and clammy. Usually this occurs in moribund cases, where there is not sufficient circulation to take up the fluid. The swelling of the tissues from the infusion readily disappears, moist heat sometimes being applied to hasten absorption. There is little or no pain after the needles are inserted, and it is well to move them a little to clear them of any tissue that might block them. After the needles are removed a collodion dressing is applied.

After using, the tubing should be rinsed and then hung up until thoroughly dried. The needles, after boiling, should be left as dry as possible. This is done by putting the wires in and out, drying each time, until the wires come out dry, the use of alcohol hastening this process. The flasks and tubing with "Y" should be used wherever possible, as it is readily seen that there is less danger from infection or contamination from the air, as the fluid goes directly into the tissues. When we are not fortunate enough to have this arrangement, there are several other things that can be substituted, such as the barrel of a glass syringe (4- or 6-ounce) fitted with rubber tubing and needle, taking care not to let the barrel become empty until the fluid is given; sterile absorbent to be placed in the top of barrel. A fountain syringe can be boiled and used, or a funnel. The funnel is our poorest substitute, as it has such a large opening it is hard to keep it covered. When we only have the one needle it is well to put it into a new place when half of the fluid is given.

THE TREATMENT OF PULMONARY TUBERCULOSIS *

BY H. H. WEIST, M.D.

(*Continued from page 14*)

THE idea that overfeeding is necessary in tuberculosis has been a principle long recognized, and it is a matter of common observation that it is not difficult to bring about large gains in weight. But that something more than making the patient fat is necessary has been evident, because the disease itself persists. Extensive and active pulmonary tuberculosis is frequently seen in over-fat individuals. It is manifest from this that something is still lacking to bring about a repair of the lesion. This essential element has been definitely proved to be lime. The lime-salts have a very important part in Nature, and are necessary parts of all vegetable and animal organisms. Lime forms three-quarters of the total mineral solids of the body and is found in all the fluids and tissues as before stated. The human skeleton is largely lime. The formation of cells, the clotting of blood, all nervous and muscular equilibrium depend upon its presence. Phosphate of lime forms a part of the normal structure of every organ in the body. Lime is being constantly discharged from the body as physiological waste material. It is therefore an essential food element. Various results must, therefore, follow an insufficient supply: (1) imperfectly developed organs; (2) lowered resistance to disease; (3) lack of power to repair physiological waste; (4) lack of power to repair injury. Imperfect structure of an organ leads to impaired function. Resistance to disease is a physiological function, therefore imperfect organs must offer imperfect resistance. Growth and repair are dependent upon cell formation. Cell formation will not take place in the absence of lime phosphate. Again, disease having been established, its extension is unobstructed, because no reparative process can occur in the absence of lime phosphate.

In the application of these principles to the treatment of tubercu-

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* Read before the New York County Nurses' Association, January, 1912.